UCRL-JC-124532 Abs

B-Field Interactions and Electrode Optimization in the Plasma Electrode Pockels Cell

S. N. Fochs, M. Garcia, M. Rhodes, Charles Boley
University of California
Lawrence Livermore National Laboratory
Livermore, CA 94583 USA
Tel. (510) 422-2976; fax (510) 422-7748; e-mail: fochs1@popsicle.llnl.gov

Poster presentation preferred

A 32 cm plasma electrode Pockels cell (PEPC) prototype at LLNL was used to determine switching performance in the presence of external magnetic fields. A separate experimental facility was used to optimize electrode design. The 32 cm prototype PEPC was then used to determine the switching performance of various electrode designs. The question of external magnetic fields becomes important when the PEPC is placed near an amplifier assembly. Flashlamp currents in excess of 25 kA can generate strong magnetic fields near the amplifier assembly and moderate magnetic fields even at some distance from the amplifier. We have modeled the fields generated by NIF amplifier bundles and have determined that the magnetic field can be as great as 50 Gauss at 0.7 m from the flashlamps. We have shown with MHD modeling that the PEPC discharge will be affected by a fields greater than 5 Gauss. To determine the actual effect these fields can have on the operation of the PEPC, a field coil was constructed to generate fields in the PEPC discharge over the range of 1 to 100 Gauss. Experiments showed that the PEPC will not work in the presence of a 50 Gauss field and is even sensitive to a 10 Gauss field.

Planar magnetron and hollow cathodes were developed and optimized for the PEPC device through a combination of theoretical modeling and experimentation on a facility separate from the PEPC. Hollow cathodes are attractive because of their inherent mechanical simplicity, and the greater uniformity of plasma they produce. Magnetron cathodes are superior in their reliability of operation over a wide range of gas pressures. The final selection of cathode type for the NIF laser will depend in part on the dimensional constraints imposed on the PEPC units. Using cathode designs based on experimental work in the off-line facility, we have demonstrated the successful operation magnetron and hollow cathode designs in the 32 cm prototype PEPC. These include thinner magnetron designs like those of our previous design and designs involving only a single row of magnets. The single row of magnets configuration will allow for, not only thinner magnetrons, but a lower cost cathode. We have done experiments on various hollow cathode designs and have concluded that trade-offs must be made in cathode internal volume and operating pressure.

* Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-ENG-48.